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AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 156

THE ARMSTRONG WHITWORTH A.W. XVI

MILITARY AIRPLANE (BRITISH)

A Single-Seat Biplane

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A Single-Seat Biplane

The A.W. XVI is a single-bay staggered biplane of metal construction and of a singularly clean external design. An exceptional performance is claimed for it. In fact, the A.W. XVI is claimed to be the fastest single-seat fighter in the world with an air-cooled engine. (Figs. 1, 2, 3, and 4.)

Naturally a large proportion of the credit for this performance must be due to the Armstrong Siddeley Jaguar-Major, or Panther, engine, with which the type is fitted. The engine is either moderately supercharged (geared fan) or fully supercharged and geared. Townend cowling rings are used. (Fig. 5.) The long exhaust pipe for silencing and flame-damping is shown in Figure 6. A lot of little extra gains in m.p.h. have been obtained by careful attention to detail and by careful streamlining.

The tail unit is bereft of external bracing with the exception of two sloping tubes, one on either side, which brace the front spar of the stabilizer with the base of the tailplane operating gear. (Figs. 7 and 8.) The tail unit is constructed of steel with fabric covering. The elevator and rudder are balanced. All navigation lights are sunk in the leading edge of the wings and the rudder. (Figs. 9 and 10.) Two engine-driven generators, one for the wireless and the other for the lighting and heating, are mounted inside the fuselage. (Figs. 11 and 12.) All strut ends, landing-gear fittings, and other drag-producing excrescences are faired. And a fashionable note is struck by the provision of "pants" or "spats" over the wheels. (Figs. 2, 4, 15, and 16.) Combined oleo and rubber springing with independently operated brakes are used. (Figs. 13 and 14.)

*From The Aeroplane, October 14, 1931. Figures 1, 6, 7, 8, 12, 17, 18, 19, and 20 taken from Flight, October 16, and 23, 1931.

One particular feature of the airplane which associates well with its high performance is the control system. The company claims that the controls are the lightest at high speed and are the most effective near the stall of any airplane in the single-seat fighter class.

The lateral control has received particular attention, and the result is a perfectly balanced control unit from which all mechanical losses have been eliminated. The wings are of unequal span in single bay, and staggered. The top wing is in two sections joined near the center line and carried above the fuselage by splayed-out N struts with one set of N struts interplaned on either side of the fuselage. (Fig. 17.) The structure follows the A.W. practice with built-up spars of rolled and drawn steel strips. The girder type ribs are built up of open sections. The leading edge is metal covered, with fabric covering for the entire wing. The ailerons, which are on all four wings, are of the narrow-chord Frise type. They are on ball bearings, and are statically balanced by having the hinge line located behind the aileron spar.

The inter-aileron balance struts are hinged to the leading edges of the ailerons (fig. 3) and also contribute towards the mass balance of the aileron system. This balance, together with the correct form of entry of the shielded leading edge of the aileron, to eliminate any form of "snatch," was the subject of a long series of flying tests. The result fully demonstrates the inestimable value of active cooperation between the design department and the really competent test pilot.

Another feature of the aileron system is an auxiliary adjustment to give perfect trim at high speeds. This consists of narrow-hinged surfaces inset into the trailing edges of the top ailerons. These can be adjusted to give perfect trim after which they are screwed up permanently.

The cockpit of the A.W. XVI is very roomy and comfortable and has been designed to give the best view forward and downward for fighting and landing.

The dimensions of the fuselage are only restricted by the maximum over-all diameter of the radial engine, but the pilot is situated fairly high up and the sides and top decking of the fuselage are so shaped as to make the presence of the Panther engine almost unnoticeable to the pilot.

lot. The structure of the fuselage is rectangular, consisting of steel tubing assembled with mechanical joint, cross-braced with swaged wires (figs. 18, 19, and 20) and covered forward with quickly detachable metal panels and aft with fabric.

The cockpit is situated just aft of the trailing edge of the upper wing, in which are two handgrips to assist the pilot in getting out, either on normal occasions or, more particularly, in emergency with parachute. Further, a door with a very robust opening device is located on the port side. Provisions are made for full night flying with wireless and heating equipment.

Both the seat and the rudder bar are adjustable. The rudder bar, which is shown in Figure 21, is very simple and effective. The bar proper has mounted above it, by two parallel-action swing links, a further cross bar which has at its extremities two independently mounted rudder pedals. The upper cross bar may be moved back or forward in relation to the lower rudder bar by a link connected to a threaded collar mounted on a worm shaft at right angles to the lower fixed rudder bar.

The rudder pedals have toe pads mounted on extensions and are free to turn independently in the ends of the upper cross bar. Each pedal is connected with a quadrant on the end of the rudder bar by a rigid link. A depression of either or both pedals applies the wheel brakes singly or together through Bowden wire connections.

The equipment of the airplane is complete, and considerable attention has been given to the most advantageous disposition of this equipment. The Sutton harness has been augmented by the addition of a partial release which enables the pilot to have access to certain of his equipment, such as rudder-bar adjustment, guns, etc., without hindrance but still with the comforting presence of the harness. Two fixed Vickers guns are mounted at the top of the cowl in front of the pilot, and adjusted to fire through the propeller. Provisions are made for mounting camera gun on the top wing. A rack for four light fragmentation bombs is mounted under the lower wing.

The result showed that all controls were fully operative. A demonstration of speed flying was largely restricted by the fact that the supercharged engine could not be opened up near the ground, but one very noticeable feature was the remarkable quietness of the engine with its long exhaust pipes as compared with a similar type airplane with open exhausts.

CHARACTERISTICS AND PERFORMANCES

Dimensions:

Span	33 ft.	10.0 m
Length, over-all	25 ft.	7.62 "
Height	11 ft. 6 in.	3.5 "
Wing area	261 sq.ft.	24.2 m ²

Weights:

Military load	530 lb.	240 kg
Weight, loaded	3,600 "	1,636 "

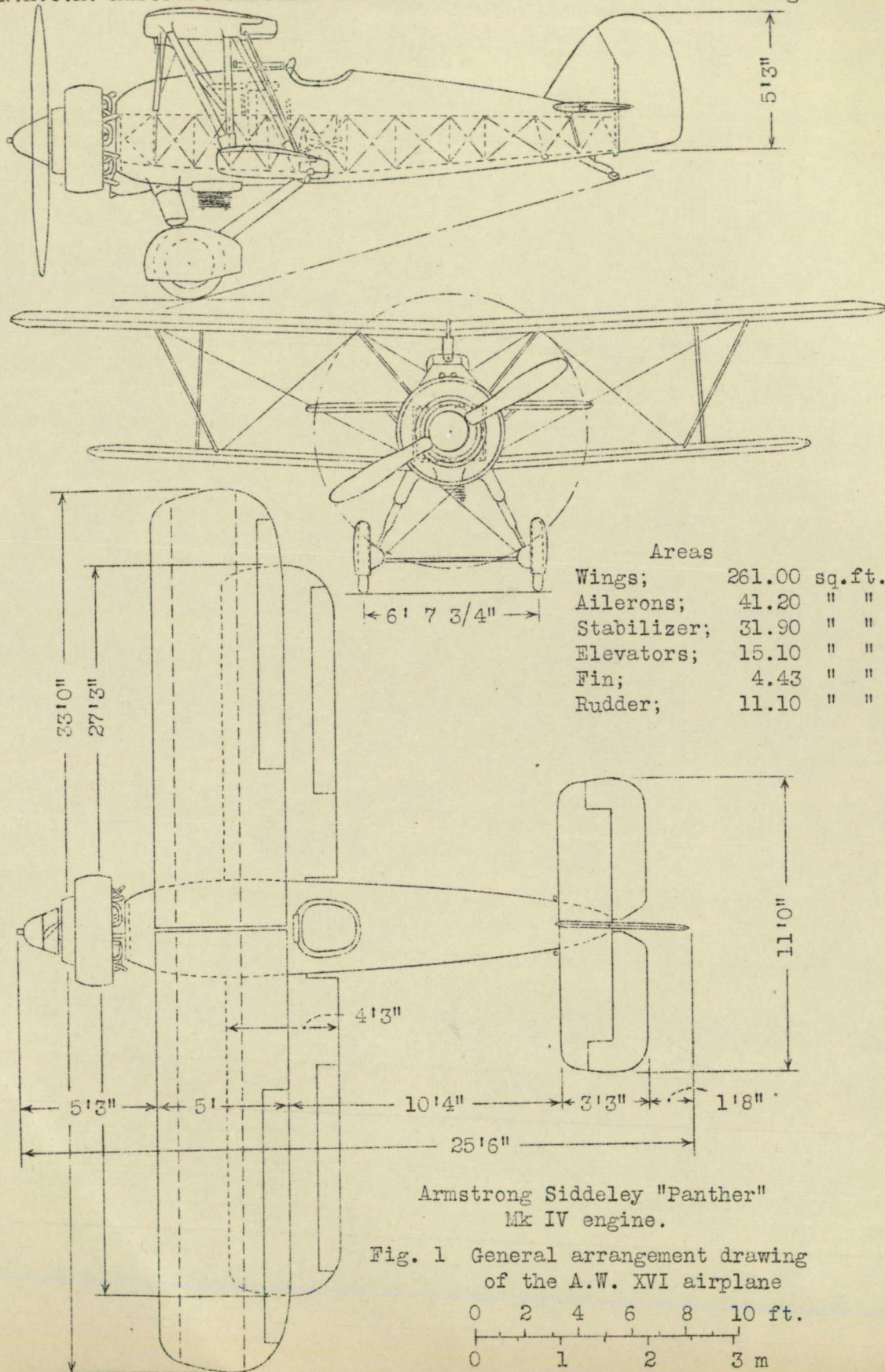
Performance (Jaguar-Major, with geared fan):

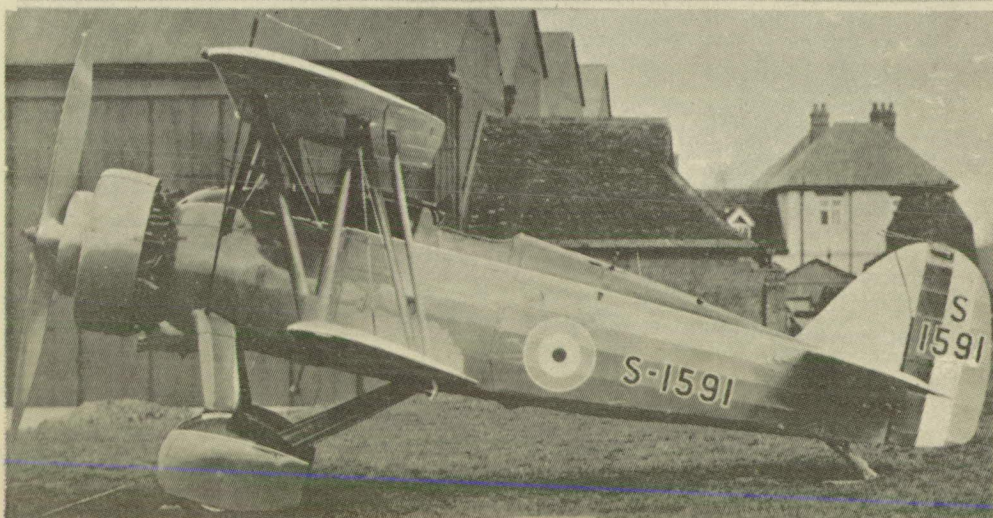
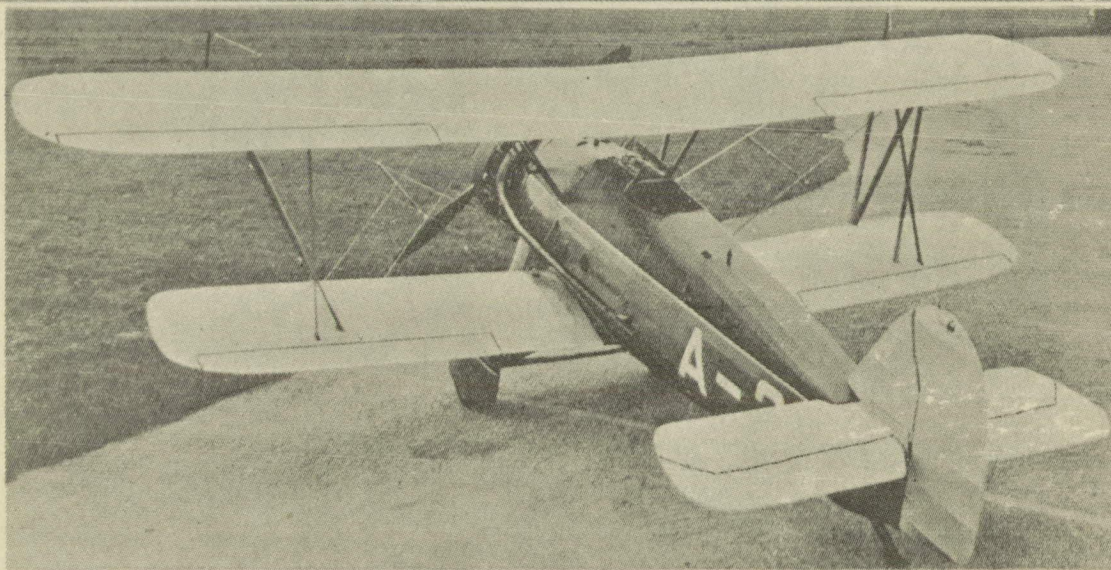
Speed at ground level	180 mi./hr.	290 km/h
" " 5,000 ft. (1,525 m)	185 "	296 "
" " 10,000 ft. (3,050 m)	182 "	291.2 "
" " 15,000 ft. (4,575 m)	177 "	283.2 "
Climb to 5,000 ft. (1,525 m)		2.75 min.
" " 10,000 ft. (3,050 m)		6.25 "
" " 15,000 ft. (4,575 m)		11.0 "

Service ceiling	25,100 ft.	7,650 m
Absolute "	26,500 "	8,080 "
Range at	$\left\{ \begin{array}{l} 3,000 \text{ ft. (914 m)} \\ 155 \text{ mi./hr. (248 km/h)} \\ \text{cruising speed} \end{array} \right\}$	345 mi. (552 km)

Performance (Jaguar-Major, supercharged and geared):

Speed at	10,000 ft. (3,050 m)	203 mi./hr.	324.8 km/h
" "	15,000 ft. (4,575 m)	200 "	320.0 "
" "	20,000 ft. (6,100 m)	195 "	312.0 "
" "	25,000 ft. (7,625 m)	187 "	299.2 "
Climb to	10,000 ft. (3,050 m)	6 min.	
" "	15,000 ft. (4,575 m)	9.5 min.	
" "	20,000 ft. (6,100 m)	14.25 min.	
Service ceiling	29,800 ft.	9,080 m	
Absolute "	31,000 "	9,450 "	
Range at	$\left\{ \begin{array}{l} 12,000 \text{ ft. (3,655 m)} \\ 170 \text{ mi./hr. (272 km/h)} \\ \text{cruising speed} \end{array} \right\}$	370 mi. (592 km)	





Figs. 2,3,4

Armstrong-
Whitworth
A.W. XVI
fleet
fighter.

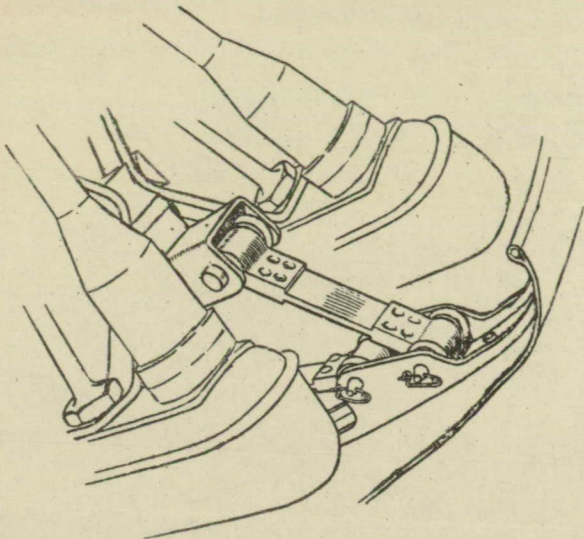


Fig. 5 Method of attaching the Townend ring to the cylinder heads.

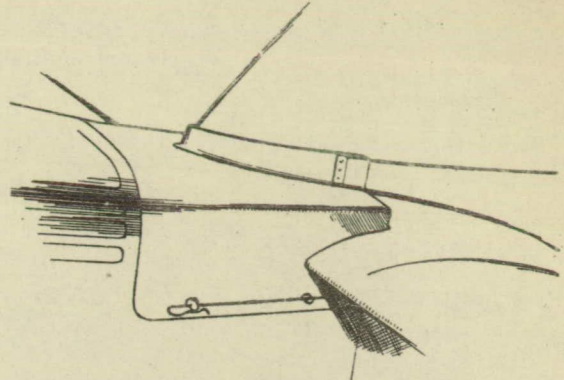


Fig. 7 Method by which the tail plane has been faired to the fuselage of A.W. XVI

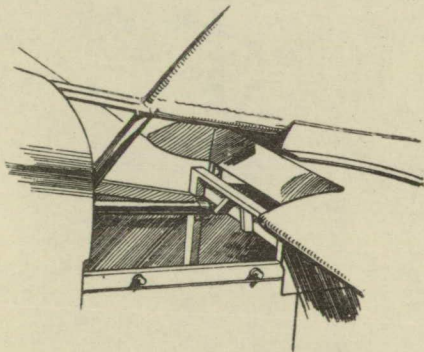


Fig. 8 Fuselage at tail unit with fairing removed showing adjusting mechanism.

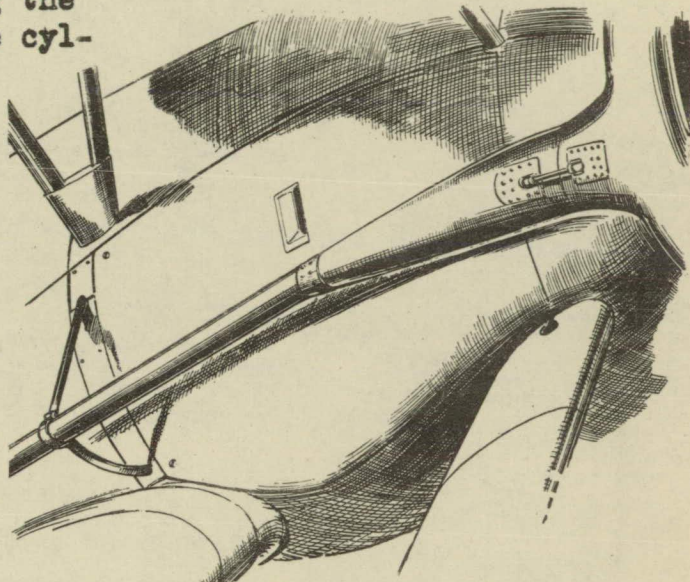


Fig. 6 View, illustrating the clean result when the fairing panel is over the generator, and showing ventilators for keeping it cool.

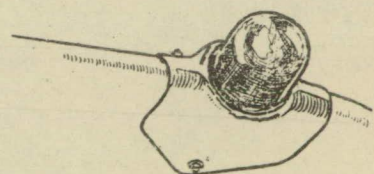
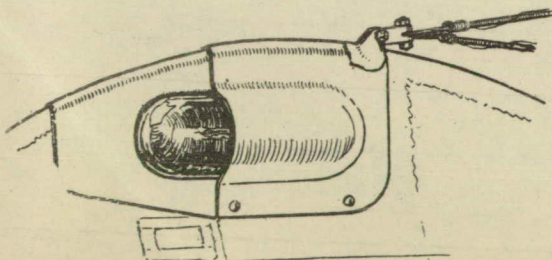


Fig. 10

Figs. 9,10 The method of streamlining the navigation lights in the rudder and leading edge of the wings.

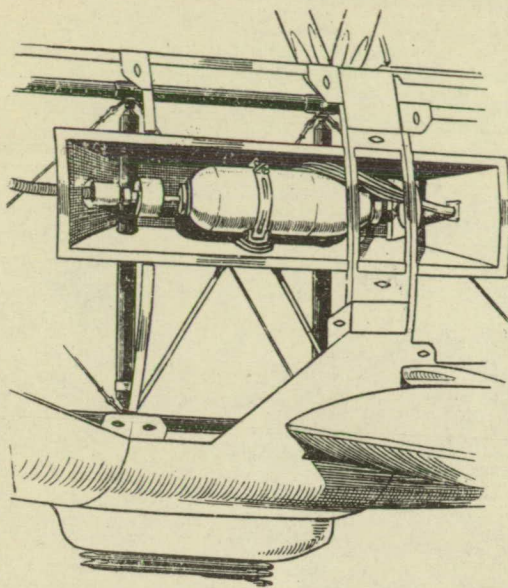


Fig. 11
The stowage
of one
of the
electric
generators
inside the
fuselage
fairing.

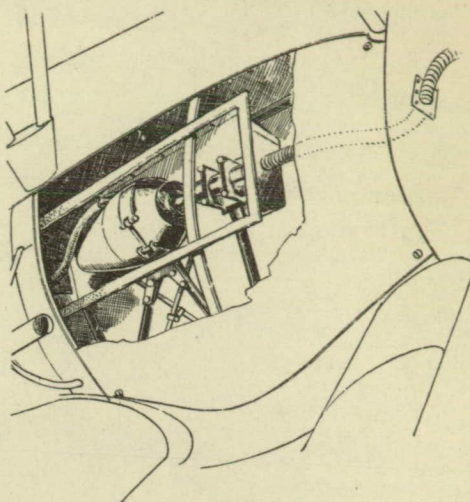


Fig. 12
Showing the
generator
for lighting
and heating
on the right-
hand side of
the airplane.

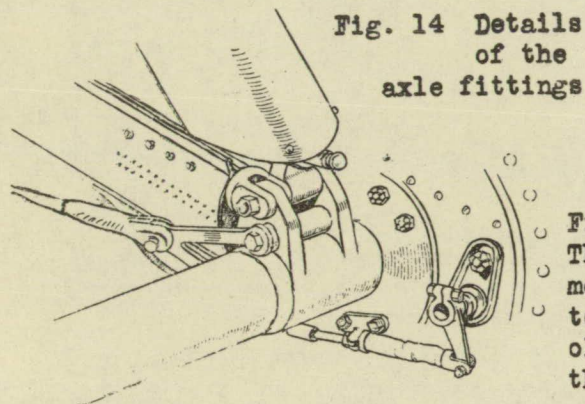


Fig. 14 Details
of the
axle fittings

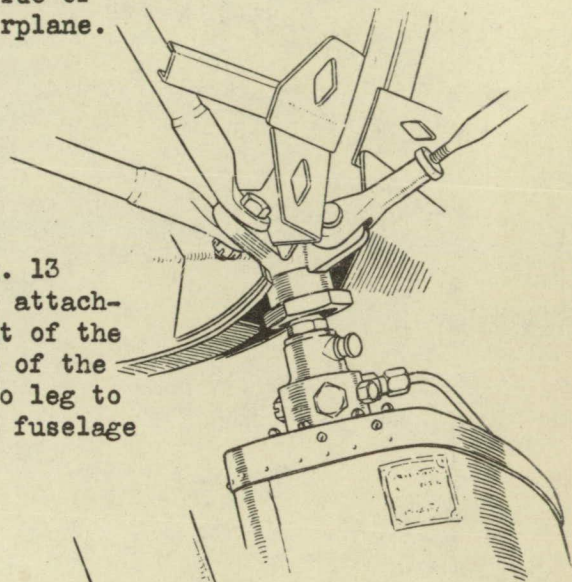


Fig. 13
The attach-
ment of the
top of the
oleo leg to
the fuselage

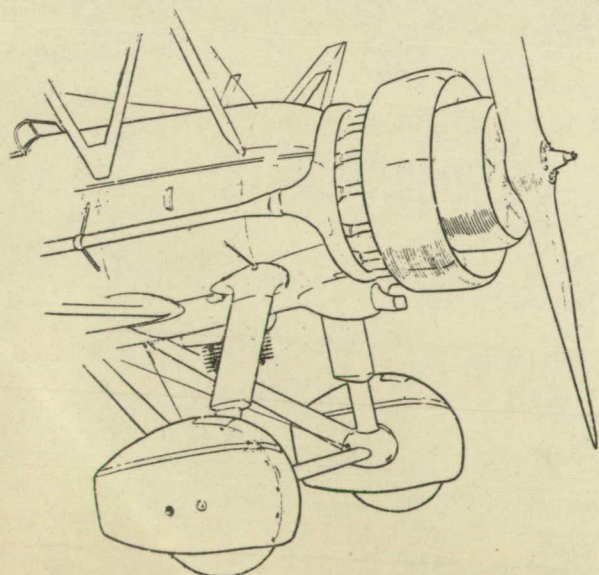


Fig. 15 View of the nose of the A.W.
XVI showing the double Town-
end ring, streamlining of the landing
gear, etc.

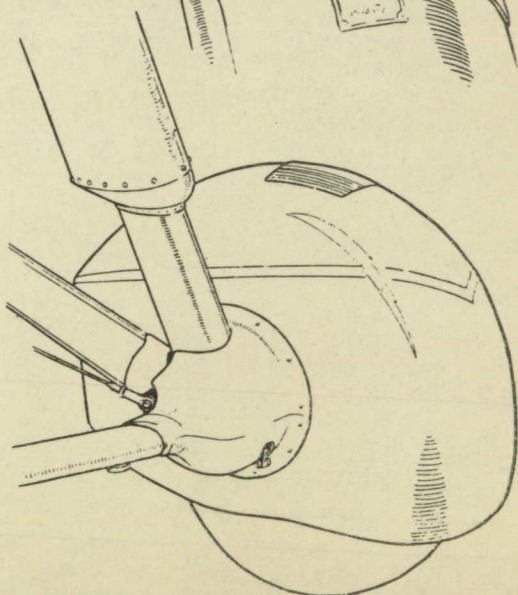


Fig. 16 Streamlining of the wheel
and axle fittings.

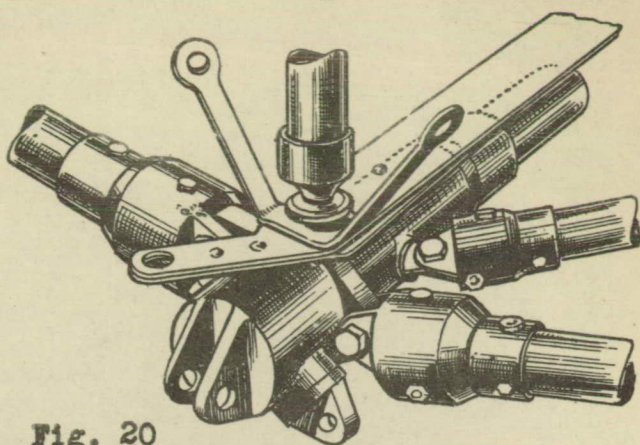
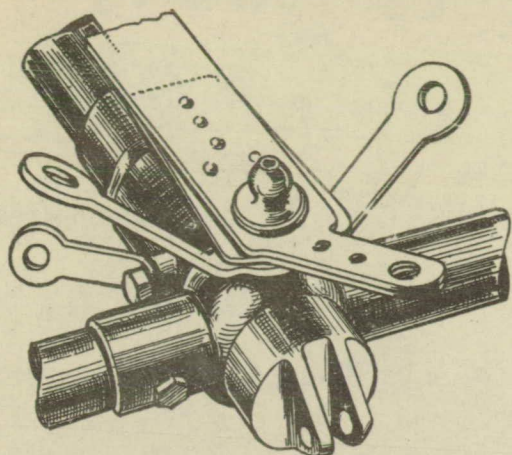


Fig. 20

Figs. 18,19,20 Examples of steel tube construction, showing in particular, the ball and cup method of attaching the vertical fuselage struts.

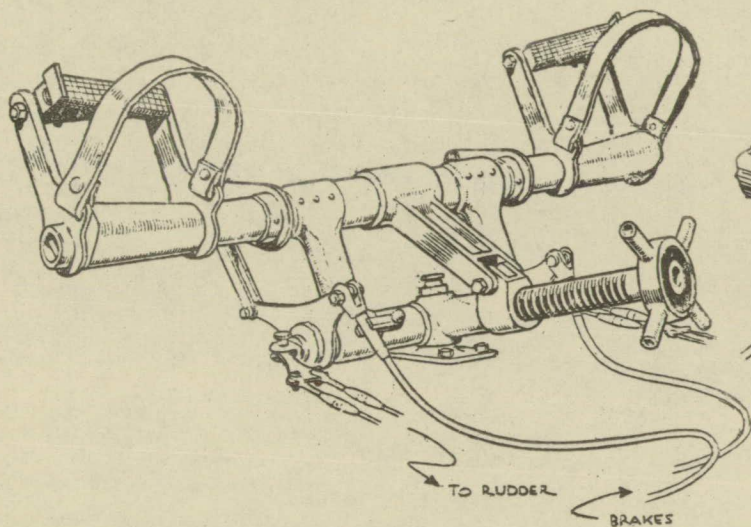


Fig. 21 Adjustable rudder bar

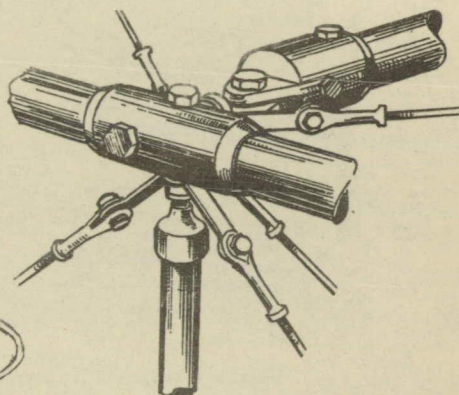


Fig. 19

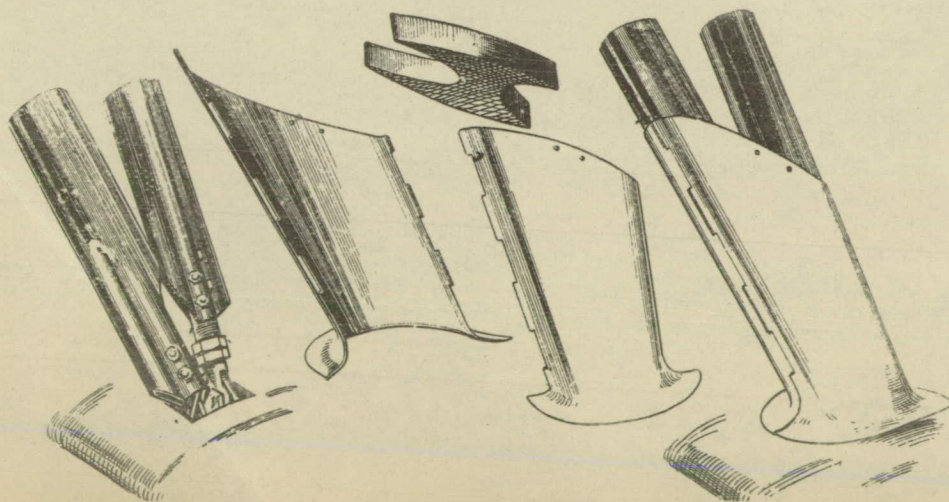


Fig. 17
Neat inter-
plane strut-
end fair-
ings and
their meth-
od of as-
sembly.